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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/707,388	12/10/2003	**Ramachandra Divakaruni**	FIS920030274US1	1387

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EXAMINER	
FULK, STEVEN J	

ART UNIT	PAPER NUMBER
2891	

NOTIFICATION DATE	DELIVERY MODE
04/11/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PTOCommunications@hwdpatents.com

Office Action Summary	Application No.	Applicant(s)	
	10/707,388	DIVAKARUNI ET AL.	
	Examiner	Art Unit	
	Steven J. Fulk	2891	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 January 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *12-18 and 20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *12-18 and 20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10 December 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Art Unit: 2891

DETAILED ACTION

Response to Amendment

1. Applicant's amendment filed January 7, 2008, which amends claims 12 and 20 and cancels claim 19, has been entered. Claims 12-18 and 20 are currently pending.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 12-18 and 20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term "damaging temperature" in claims 12 and 20 renders the claims indefinite. The term "damaging temperature" is defined as "a temperature at which damage is probable to occur in any of the plurality of BEOL layers" (Specification, ¶19). The term "probable" is not defined by the specification, therefore the ordinary definition of "establishing a probability" has been applied (per Webster's definition, previously provided). Because the specification does not establish a probability of damage at the silicidation temperature, it is not sufficiently clear whether or not damage occurs to the BEOL layers. Thus one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Insofar as definite, claims 12, 18 and 20 are rejected under 35 U.S.C. 102(b) as being anticipated by Yoo et at. '984.

The limitation of "a silicide section having a silicidation temperature less than a damaging temperature of the plurality of BEOL layers" found in product claims 12 and 20 invokes the product-by-process doctrine. Product-by-process claims are not limited to the manipulations of the recited steps, only the structure implied by the steps (*MPEP § 2113*). Therefore, anticipation of claims 12 and 20 does not require the silicide section to be formed by silicidation, only that the material used for the silicide has a known silicidation temperature which meets the requirements of the claim.

By both the conventional definition in the art and by the Applicant's definition provided in the specification, a back-end-of-line (BEOL) layer can comprise any ILD layer (Applicant's specification, ¶16, "ILD layer may be any BEOL layer…containing a via and/or metal.") or any metal layer (Applicant's specification, ¶18, "conventional BEOL wiring structure could be…a via to underlying wiring layers or a simple wire."), so long as the layer is formed over the front-end-of-line (FEOL) structures found on a silicon substrate.

Yoo discloses a semiconductor device comprising: a silicide resistor (fig. 13; layer 30c is formed of polysilicon layer 30a and tungsten silicide layer 30b; col. 8, lines 54-66; layers 30a/30b have an inherent resistance, thus considered a resistor) in one of a plurality of back-end-of-line layers (formed in interlayer

dielectric 27 formed over FEOL layers 1-17; layer 31 is a second BEOL layer, thus 27 and 31 are a plurality), the silicide resistor including a silicide section (30b, tungsten silicide) having a silicidation temperature less than a damaging temperature of the plurality of BEOL layers (tungsten silicide inherently has a silicidation temperature of ~600°C) and a polysilicon base (30a) positioned below the silicide section; wherein the silicide section and the polysilicon base are is positioned in a trough in one of the plurality of BEOL layers (layers 30a/30b formed in trough opening of layer 27; col. 8, lines 36-53).

Wolf, Vol. II (NPL Reference "U", previously provided) provides further evidence of the inherency of the silicidation temperature of tungsten (group VIII) metals being ~600 °C (p. 146). This silicidation temperature of tungsten is read as "a silicidation temperature less than a damaging temperature of the plurality of BEOL layers" in light of the fact that the Applicant's specification gives illustrative examples (species) of silicidation temperatures less than a damaging temperature of the plurality of BEOL layers (genus) that includes 600 °C for tungsten silicide. Yoo discloses the plurality of BEOL layers to comprise silicon oxide, which is well known in the art to be able to withstand temperatures of ~ 600°C without damage.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 13-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yoo et al. '984 in view of Wolf, Vol. II (NPL Reference "U", previously provided).

Yoo discloses all of the elements of the claims as discussed in paragraph 5, including the use of tungsten silicide, but the references does not explicitly teach the use of cobalt silicide, palladium silicide, platinum silicide or nickel silicide.

Wolf teaches the use of group VIII silicides, including cobalt, palladium, platinum, and nickel silicide, in BEOL resistors (Wolf defines "multilevel interconnects" to include ILD layers, vias, and metal lines (p. 176), thereby meaning BEOL layers as defined above; and because interconnects inherently have a resistance, they are classified as "resistors"). Wolf also teaches the inherent resistivity associated with each silicide (p. 193, Table 4.3; p. 146): cobalt silicide has a resistivity between 14-20 μ-ohm/cm (p. 193, Table 4.3); palladium silicide has a resistivity between 25-30 μ-ohm/cm (p. 146); platinum silicide has a resistivity between 26-35 μ-ohm/cm (p. 193, Table 4.3); and nickel silicide has a resistivity of 50 ohm/cm (p. 146). Wolf teaches the silicidation temperature of the group VIII metals as 600 °C or less (p. 146), which reads on a silicidation temperature less than a damaging temperature of the plurality of BEOL layers as defined above.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the cobalt silicide, palladium silicide, platinum silicide or nickel silicide material of Wolf in the resistor of Yoo. One would have been motivated to do this because Wolf taught that tungsten, cobalt, palladium, platinum

and nickel were art recognized functional equivalents for forming silicides in semiconductor devices (p. 146) (MPEP § 2144.06).

Response to Arguments

8. Applicant's arguments with respect to the 35 U.S.C. 112, 2nd paragraph rejection of claims 12-18 and 20 have been fully considered but they are not persuasive. Applicant defines the term "damaging temperature" as "a temperature at which damage is probable to occur in any of the plurality of BEOL layers" (Specification, ¶19). The Examiner interpreted "probable" as meaning "establishing a probability". Applicant argues that this definition of "probable" does not apply to the damaging temperature in the claimed invention because it is not consistent with the context in which the term "probable" is used. Applicant argues that, in the context of the current specification, the phrase "is probable to" is equivalent to "is likely to be or become true or real".

This argument is not persuasive because the applied definition of "probable" as "establishing a probability" is relevant to the context of the specification in that it requires a known probability to be established or given. Therefore, this definition of probable applied the term "damaging temperature" would be interpreted as "a temperature at which damage occurs with a known probability". Because the specification does not establish a known probability of damage at the silicidation temperature, it is not sufficiently clear whether or not damage occurs to the BEOL layers. Thus one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

9. Applicant's arguments with respect to the prior art rejections of claims 12-18 and 20 have been considered but are moot in view of the new ground(s) of rejection as set forth above.

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Roberts '222 teaches a resistor with silicide section (fig. 3, 32) and a polysilicon base (31) below the silicide section.

11. Applicant's amendment to claim 12 and 20, wherein the polysilicon base is now required to be in the trough, necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven J. Fulk whose telephone number is (571)272-8323. The examiner can normally be reached on Monday through Friday, 8:00am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Baumeister can be reached on (571) 272-1722. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

13. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Steven J. Fulk
Patent Examiner
Art Unit 2891

April 2, 2008

/BRADLEY W BAUMEISTER/
Supervisory Patent Examiner, Art Unit 2891